The Process of Ageing

Introduction

Types of aging

Pathogeric: pathological aging, not a predestined part of aging.

Eugeric: "true" aging, age related changes that will happen to everyone, inevitable.

Numerous changes are associated with the aging process. These include:

- External appearance:
  - Hair - greying, thinning
  - Skin - loses elasticity, wrinkles
  - Dimensions - get shorter because of scoliosis or kyphosis, foot arches fall and intervertebral disks dry out
  - Use of prostheses e. g. false teeth, wigs
  - Use of medical treatments e.g. liposuction
  - Body composition changes - less muscle, more fat, reduced bone mass, loss of intracellular water

- Mental capabilities:
  - Large variance with chronological age changes
  - Decreased ability to process information
  - Loss of short term memory, then long term memory

- Endocrine characteristics:
  - Menopause
  - Carbohydrate tolerance - onset of Type II diabetes

- Physiological/Biochemical changes:
  - Decreased renal function
  - Onset of arthritis
  - Onset of osteoporosis
  - Decreased cardiac index
  - Decreased nerve conduction velocity
  - Decreased acuity of the senses (hearing, seeing, tasting, touching, smelling)

  - Decreased isoimmunity (as measured by titers and autoimmunity titers)

- Muscle:
  - Decreased strength

- Decreased size of muscle fibres
- Decreased number of FT fibres
- Poorer physical fitness

- Cardio respiratory system:
  - Decreased O_2 uptake
  - Decreased maximum heart rate
  - Increased CV disease
  - Increased incidence of hypertension

- Other:
  - Increased susceptibility to anxiety (which may effect decision-making abilities)
  - Increased reaction time
  - Increased movement time

Important Facts To Remember About the Ageing Process

- All the cells, organs and systems of the human body age at different *rates*.
- At *rest*, few differences in physiological and biochemical functions occur with ageing (e.g. no effect on blood acidity or electrolyte or glucose concentration).
- With displacement of *homeostasis*, the rates at which the readjustments toward normal occur are slower in the elderly i.e. the effectiveness of the control mechanism.
- Basal metabolic rate (*BMR*) decreases with age reflect totally the loss of metabolizing tissue (i.e. cells die and are replaced by fat and connective tissue)
- Many of the decreases found are the result of *integrated* activity of more than one system e.g. maximum O_2 decreases 60-70% and is affected by the cardiovascular, respiratory, nervous and muscular systems. *Remember usually, the curves shift to the right.*
- The *variation* within a particular age cohort is often nearly as great as the variation among age cohorts. Therefore, in cross-sectional studies, no single age emerges as the point of sharp demarcation.

Ageing of Homeostatic Processes

Homeostasis
: The maintenance of relatively stable internal physiological conditions (as body temperature or the pH of blood) under fluctuating environmental conditions.

Control loops maintain an optimized internal environment: sensor (receptors), control (central regulation and target value), effectors (outflow via nerves and endocrine), "negative feedback loop" (reduce the deviation from the target). Generally, an increase in time for equilibration (i.e. increased response time) is observed with aging.

- **Receptors**: loss of sensitivity
  - Baroreceptors, chemoreceptors
  - Loss of cutaneous receptor
- **Regulatory centres**
  - No major loss of neurons; only small changes in target set-point
  - Loss of precision - greater deviations necessary

- **Endocrine Regulation**
  - Variable by organ; e.g. aldosterone for regulation of salt content markedly reduced in secretion and blood levels

- **Autonomic Outflow**
  - Animal studies, significant age changes; transmission slowed (autonomic ganglia), but increased post-ganglionic sensitivity to neurotransmitter (like denervation hypersensitivity)
  - Cholinergic - reduced rate of acetylcholine synthesis
  - Adrenergic - increased neurotransmitter release, but reduced catecholamine receptors (less sensitivity and responsiveness)

- **Regulatory effectors**
  - Deterioration of function e.g. heart nodal pacemaker tissue; inotropic - reduction in compliance, loss of mass, reduction in beta-receptors, e.g. sweat glands number reduced.